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RULES

FOR THE

ORGANIZATION AND GOVERNMENT

OF THE

ANNUAL BOARDS

OF

ASSAY COMMISSIONERS,

EMBRACING ALSO, THE

LAWS OF THE UNITED STATES

RELATING TO THE

DUTIES OF THE COMMISSIONERS.

AND A BRIEF ACCOUNT

OF THE PROCESSES EMPLOYED IN THE ASSAY OF

GOLD AND SILVER COINS,

AT THE

MINT OF THE UNITED STATES.

Prepared in accordance with a Resolution of the Commissioners for 1856; and printed by order of the Director of the Mint.

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The Rules herein printed have been prepared by the Committee appointed by the Commission which met on the Second Monday of February, 1856. viz:

JOHN K. KANE,
Judge of the District Court of the United States for the Eastern Dlstrict of Pennsylvania.

JAMES C. VANDYKE,
Attorney of the U. S. for the Eastern District of Pa.

CHARLES BROWN,
Collector of the Port of Philadelphia.

JAMES ROSS SNOWDEN,
Director of the Mint.

B.S.S.

RULES

FOR

THE ORGANIZATION AND GOVERNMENT OF THE

BOARD OF COMMISSIONERS,

Prepared in accordance with a Resolution of the Board for 1856.

WITH THE

ACTS OF CONGRESS RELATING TO THEIR DUTIES.

AND A BRIEF ACCOUNT OF THE

PROCESS EMPLOYED IN THE ASSAY.

RULES.

I.

The Chair will be taken at the appointed hour by the Judge of the District Court of the United States, or in case of his absence by such member as the Commissioners present may designate; the Director's Clerk will act as Secretary unless otherwise ordered by the Board. Officers.

II.

The letters of the Secretary of the Treasury, naming the Commissioners who have been specially designated by the President of the United States, will be read. Letters.

III.

A quorum being present, the Secretary will read the 32d Section of the Act of Congress of the 18th of January, 1837, under which the Commission is constituted; the several laws bearing upon the duties of the Commissioners; the Rules for the organization and government of the Board; and the minutes of the last preceeding assay. Quorum.

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IV.

Reserved Coin.

The Reserved Coins having been produced by the officers in charge of them, the several packages in which they are contained will be opened in the presence of the Commissioners, and the Coins distributed by them in parcels, with reference to their places of Coinage and their metallic character, as follows:

1 Gold Coins from the Mint at Philadelphia:

2 Silver Coins from the same:

3 Gold Coins from the Branch Mint at New Orleans:

4 Silver Coins from the same:

5 Gold Coins from the Branch Mint at San Francisco:

6 Silver Coins from the same:

7 Gold Coins from the Branch Mint at Charlotte:

8 Gold Coins from the Branch Mint at Dahlonega:

But when it shall be made known to the Board, that at the Mint or either of the Branches, there has taken place during the year a change in any of the Officers that are responsible for the Coinage, the Coins made during the terms of the respective incumbents, will be distributed in separate parcels.

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V.

Coins to be weighed.

The number of Coins contained in each parcel will then be ascertained by weighing in the manner ordinarily practised at the Mint, and in accordance with the number reported as "reserved," shall be noted by the Secretary on the minutes.

VI.

Arrangement of Committees.

The Chairman will then arrange the members of the Board in two committees; one to take charge of the weighing, the other of the assaying; with power to associate members interchangeably, and to require the manipulatory aid of the officers of the Mint.

VII.

Of the Weighing:

Committee on weighing.

A. The committee on weighing shall take from each parcel of the Coins, as distributed two or more piles,—each of ten or more pieces, and embracing two or more denominations,—and five or more single pieces, of two or more differing denominations.

B. They shall arrange the piles and the single pieces, thus taken out, with the Mint marks downwards, in such order that the particular mintage shall be known only to the members of the committee.

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C. The piles and the single pieces, shall then be severally weighed under the scrutiny of the committee, and their respective weights ascertained; the piles to the one thousandth of an ounce, the single pieces to the eight of a grain; and the results shall be noted, with a special reference as to any that may be found without the legal limits of weight.

D. The committee shall then examine the weights ordinarily employed in the Mint, and shall attest their accordance with the standards prescribed by law.

VIII.

Of the Assaying.

Of Assaying.

E. The committee on Assaying shall receive the residues of the several parcels of reserved Coins; and adding to them—if it shall be necessary, but not otherwise, from the piles in the possession of the committee on weighing, shall first cause a portion of each parcel to be melted into an ingot of convenient size; and from each of the ingots, so made, they shall take test samples for Assay.

F. They shall then select a convenient number, not less than three, of single pieces of diverse denominations from each parcel; from which they shall take test samples for Assay.

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G. They shall then arrange all the test samples in such order as shall be known only to the members of the committee; and in that order such sample shall be Assayed, the silver first, and the gold afterwards.

H. Should the operations of the assay be not consumated before the adjournment of the Board for the day, the parcels of reserved Coins, ingots, and test samples will remain in a chest or vault, under the joint and separate charge of the Chairman, and the Director of the Mint.

IX.

Committee to report.

The weighings and Assayings having been completed under the scrutiny of the committees respectively, the committees will report fully and specially as to the Coins of each Mint.

X.

Record of business.

And thereupon the Commissioners will proceed to declare their judgment by an open vote; and a full record thereof, and of all their doings having been engrossed by the Secretary, it will be signed by all the members, and delivered to the Director of the Mint. After which the Board will be adjourned *Sine die.*

Adjournment.

The foregoing rules have been prepared as a convenient mode of discharging the duties

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assigned to the Commissioners of the Annual Assay. They will however be subject to such modifications or alterations as a majority of the Board may, at any time during each Annual Assay, deem expedient and proper.

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LAWS OF THE UNITED STATES

WHICH RELATE TO THE RESERVATION OF

COINS FOR THE ANNUAL ASSAY

AND TO THE

DUTIES OF THE COMMISSIONERS.

LAWS OF THE UNITED STATES

WHICH RELATE TO THE RESERVATION OF

COINS FOR THE ANNUAL ASSAY.

AND TO THE DUTIES OF THE COMMISSIONERS.

ACT OF JANUARY 18th, 1837.

Coins to be reserved for the annual assay.

SECT. 27.—And be it further enacted, That at every delivery of Coins made by the Chief Coiner to the Treasurer, it shall be the the duty of the Treasurer, in the presence of the Assayer, to take indiscriminately, a certain number of pieces of each variety for the annual trial of coins, (the number being prescribed by the Director,) which shall be carefully labelled and deposited in a chest appropriated for the purpose, kept under the joint care of the Treasurer and Assayer, and so secured that neither can have access to its contents without the presence of the other.

Annual assay of coins.

SECT. 32.—And be it further enacted. That to secure a due conformity in the gold and silver coins, to their respective standards and weights; an annual trial shall be made of the

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pieces reserved for this purpose at the Mint and its Branches, before the Judge of the District Court of the United States for the Eastern District of Pennsylvania, the Attorney of the United States for the Eastern District of Pennsylvania, and the Collector of the Port of Philadelphia, and such other persons as the President shall from time to time designate for that purpose, who shall meet as Commissioners for the performance of this duty, on the second Monday in February, annually, and may continue their meetings by adjournment, if necessary; and ifa majority of the commissioners shall fail to attend at any time appointed for their meeting, then the Director of the Mint shall call a meeting of the commissioners at such other time as he may deem convenient; and that before these commissioners or a majority of them, and in the presence of the officers of the Mint, such examination shall be made of the reserved pieces as shall be judged sufficient; and if it shall appear that these pieces do not differ from the standard fineness and weight by a greater quantity than is allowed by law, the trial shall be considered and reported as satisfactory; but if any greater deviation from the legal standard or weight shall appear, this fact shall be certified to the President of the United States, and if, on a view of the circumstances of the case, he shall so decide, the officer or officers implicated in the error shall

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be thenceforward disqualified from holding their respective offices

Standard for gold and silver coin.

SEC. 8.—And be it further enacted, That the standard for both gold and silver coins of the United States shall hereafter be such, that of one thousand parts by the weight, nine hundred shall be of pure metal, and one hundred of alloy; and the alloy of the silver coins shall be of copper, and the alloy of the gold coins shall be of copper and silver, provided that the silver do not exceed one-half of the whole alloy.

Alloys.

Weight of silver coins.

SECT. 9.—And be it further enacted, That of the silver coins, the dollar shall be of the weight of four hundred and twelve and one-half grains; [the half dollar of the weight of two hundred and six and one-fourth grains; the quarter dollar of the weight of one hundred and three and one-eighth grains; the dime, or tenth part of a dollar, of the weight of forty-one and one-fourth grains; and the half dime, or twentieth part of a dollar, of the weight of twenty and five-eighth grains.] And that dollars, [half dollars, quarter dollars, dimes, and half dimes,] shall be legal tenders of payment, according to their nominal value, for any sums whatever.*

*See Acts of Feb. 21, '53,—March 3, '51.

Weight of gold coins.

SECT. 10.—And be it further enacted, That of the gold coins, the weight of the eagle shall be two hundred and fifty-eight grains; that of the half eagle one hundred and twenty-nine grains; and that of the quarter eagle sixty-four and one-half grains. And that, for all sums

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whatever, the eagle shall be a legal tender of payment for ten dollars; the half eagle for five dollars; and the quarter eagle for two and a half dollars.*

*See Acts of March 3, '49.—Feb. 21, '53.

Allowed variation from standard in the ingots.

SECT. 22.—And be it further enacted, That no ingots of gold shall be used for coinage, of which the quality differs more than two thousandths from legal standard; and that no ingots of silver shall be used for coinage, of which the quality differs more than three thousandths from the legal standard.*

*See Act of Mar. 3, 51.

Allowed variation from standard weights of the coins.

SECT. 25.—And be it further enacted, That in adjusting the weight of the coins, the following deviations from the standard weight shall not be exceeded in any of the single pieces:—In the dollar and half dollar, one grain and a half; in the quarter dollar, one grain; in the dime and half dime, half a grain; in the gold coins, one quarter of a grain; in the copper coins, one grain in the pennyweight; and that in weighing a large number of pieces together, when delivered from the Chief Coiner to the Treasurer, and from the Treasurer to the depositors, the deviations from the standard weight shall not exceed the following limits:* Four pennyweights in one thousand dollars; three pennyweights in one thousand half dollars; two pennyweights in one thousand quarter dollars; one pennyweight in one thousand dimes; one pennyweights in one thousand eagles: one and a half pennyweight in one thousand half eagles; one pennyweight in one thousand quarter eagles.

*See Acts of March 3, '49—March 3, '51.

ACT OF MARCH 3d, 1849.

Deviation of weight allowed in the gold coin

SECT. 4.—That in adjusting the weights of Gold coins henceforward, the following deviaront from the standard weight shall not be exceeded in any of the single pieces, namely, in the double eagle, the eagle, and the half eagle, one-half of a grain, and in the quarter eagle and gold dollar, one-quarter of a grain, and that in weighing a large number of pieces together, when delivered from the Chief Coiner to the Treasurer, and from the Treasurer to the depositors, the deviation from the standard weight shall not exceed three pennyweights in one thousand double eagles; two pennyweights in one thousand eagles; one and one half pennyweight in one thousand half eagles; one pennyweight in one thousand quarter eagles; and one half pennyweight in one thousand gold dollars.

AMENDMENTS RELATING TO SILVER COINAGE, MINT CHARGES, STAMPED BARS, &c.

ACT OF MARCH 3d, 1853.

New weights prescribed for silver coin.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the first day of June, eighteen hundred and fifty-two, the weight of the half dollar or piece of fifty

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cents shall be one hundred and ninety two grains, and the quarter dollar, dime, and half-dime, shall be, respectively, one-half, one-fifth, and one-tenth, of the weight of the said half dollar.

Three dollar piece authorised.

SEC. 7.—And be it further enacted, That from time to time there shall be struck and coined at the Mint of the United States and the branches thereof, conformably in all respects to law, and conformably in all respects to the standard of gold coins now established by law, a coin of gold of the value of three dollars or units, and all the provisions of an act entitled "An act to authorize the coinage of gold dollars and double eagles," approved March third, eighteen hundred and forty-nine, shall be applied to the coin herein authorized, so far as the same may be applicable; but the devices and shape of the three dollar piece shall be fixed by the Secretary of the Treasury.

Standard weight & fineness of three cents piece altered.

And that hereafter the three cent coin now authorised by law shall be made of the weight of three-fiftieths of the weight of the half dollar, as provided in said act, and of the same standard of fineness. And the said act entitled "An act amendatory of existing laws relative to the half dollar, quarter dollar, dime, and half dime," shall take effect and be in full force from and after the first day of April, one thousand eight hundred and fifty-three, any thing therein to the contrary notwithstanding.

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ACT OF MARCH 3d, 1835.

Director of the Mint at Philadelphia to have general control of the Branch Mints; his duties for that purpose.

SECT. 4.—And be it further enacted, That the general direction of the business of the said Branches of the Mint of the United States shall be under the control and regulation of the Director of the Mint at Philadelphia, subject to the approbation of the Secretary of the Treasury; and for that purpose it shall be the duty of the said Director to prescribe such regulations, and require such returns, perodically and occasionally, as shall appear to him to be necessary, for the purpose of carrying into effect the intention of this act in establishing the said Branches: also, for the purpose of discriminating the coins which shall be stamped at each Branch, and at the Mint itself: also, for the purpose of preserving uniformity of weight, form and fineness, in the coins stamped at each place. And for that pnrpose, to require the transmission and delivery to him at the Mint, from time to time, of such parcels of the coinage of each branch as he shall think proper, to be subjected to such assays and tests as he shall direct.

STANDARD WEIGHTS OF THE MINT.

ACT OF MAY 19th, 1828.

Be it enacted, &c., That, for the purpose of securing a due conformity in weight of the coins

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Standard Troy pound of the Mint declared.

of the United States, to the provisions of the ninth section of the act, passed the second of April, one thousand seven hundred and ninety-two, entitled "An Act establishing a Mint, and regulating the coins of the United States," the brass Troy pound weight procured by the minister of the United States, at London, in the year one thousand eight hundred aud twenty-seven, for the use of the Mint, and now in the custody of the Director thereof, shall be the standard Troy pound of the Mint of the United States, conformably to which the coinage thereof shall be regulated.

Corresponding weights to be procured for the Mint, and attested at the annual assay.

And be it further enacted, That it shall be the duty of the Director of the Mint to procure, and safely to keep, a series of standard weights, corresponding to the aforesaid Troy pound, consisting of a one pound weight and the requisite sub-divisions and multiples thereof, from the hundredth part of a grain to twenty-five pounds; and that the Troy weights ordinarily employed in the transactions of the Mint, shall be regulated according to the above standards, at least once in every year, under his inspection and their accuracy tested annually in the presence of the Assay Commissioners, on the day of the annual assay.

ACT OF MARCH 3d, 1851.

And be it further enacted, That from and after the passage of this act, it shall be lawful to

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coin at the Mint of the United States, and its Branches, a piece of the denomination and legal value of three cents, or three hundredths of a dollar, to be composed of [three-fourths silver and one-fourth copper, and to weigh twelve grains and three-eighths of a grain;]* that the said coin shall bear such devices as shall be conspicuously different from those of the other silver coins, and of the gold dollar, but having the inscription United States of America, and its denomination and date; and that it shall be a legal tender, in payment of debts, for all sums of thirty cents and under; and that no ingots shall be used for the coinage of the three cent piece herein authorized, of which the quality differs more than five-thousandths from the legal standard; and that in adjusting the weight of the said coin, the following deviations from the standard weight shall not be exceeded, namely, one half of a grain in the single pieces, and one pennyweight in a thousand pieces.

Three Cent Piece authorized.

*See Act of Mar. 3, '53, §7.

A Legal Tender for thirty cents

Allowed variations of weight and fineness.

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A BRIEF ACCOUNT

OF THE PROCESSES EMPLOYED IN THE

ASSAY OF GOLD AND SILVER COINS

AT THE MINT OF THE UNITED STATES.

PREPARED FOR THE USE OF THE COMMISSIONERS APPOINTED TO ATTEND THE ANNUAL ASSAYS.

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ASSAY OF GOLD COINS.

PRINCIPLES OF THE OPERATION.

According to law, the standard gold of the United States is so constituted, that in 1000 parts by weight, 900 shall be of pure gold, and 100 of an alloy composed of copper and silver.

The process of assay requires that the copper and silver be both entirely removed from the gold; and to effect this, two separate operations are necessary.

Removal of the Copper.

The first is for the removal of the copper; and this is done by a method called *cupellation*, which is conducted in an assay furnace, in a cupel composed of calcined bones. To the other metals, lead is added; this metal possesses the property of oxidizing and vitrifying under the action of heat; of promoting, at the same time, the oxidation of the copper and other base metals; and of drawing with it, into the pores of the cupel, the whole of these metals, so as to separate entirely this part of the alloy, and to leave behind the gold and silver only.

Separation of the Silver.

The separation of the silver from the gold is effected by a process founded on the property

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possessed by nitric acid of dissolving silver, without acting upon gold. That this may be thoroughly accomplished, it is found necessary that there be an excess of silver over the gold, as othewise the latter metal will cover and protect the silver from the action of the acid.

Experience has shown that the silver present should be two-thirds or three-quarters of the whole mass,—a condition which has given to the process the name of *quartation*.

PROCESS OF ASSAY.

Melting of the reserved coins.

The reserved gold coins are placed in a black lead crucible, and covered with borax, to assist the fluxing and to prevent oxidation of the copper alloy. They are thus melted down and stirred; by which a complete mixture is effected, so that an assay piece may be taken from any part of the bar cast out. The piece taken for this purpose is rolled out for convenience of cutting. It is then taken to an assay balance (sensible to the ten-thousandth of a half gramme or less,) and from it is weighed a half gramme, which is the normal assay weight for gold, being about 7. 7 grains troy. This weight is stamped 1000; and all the lesser weights, (afterwards brought into requisition,) are decimal divisions of this weight, down to one ten-thousandth part.

Silver is next weighed out for the quartation; and as the assay-piece, if standard, should contain 900 thousandths of gold, there must be three times this weight, or 2700 thousandths of silver; and this is accordingly the quantity used. It is true that there is already some silver in the alloy, but a little excess over the quantity required for the quartation does no injury to the process.

The lead used for the cupellation is kept prepared in thin sheets, cut into square pieces, which should each weigh about ten times as much as the gold under assay.

The lead is now rolled into the form of a hollow cone; and intothi s are introduced the assay-gold and the quartation-silver, when the lead is closed round them, and pressed into a ball.

The furnace having been properly heated, and the cupels placed in it and brought to the same temperature, the leaden ball, with its contents, is put into one of the cupels, the furnace closed, and the operation allowed to proceed, until all agitation has ceased to be observed in the melted metal, and its surface has become bright.

This is an indication that the whole of the base metals have been converted into oxides and absorbed by the cupel.

The cupellation being thus finished, the metal is allowed to cool slowly, and the disc or *button* whichit forms is detached from the cupel.

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The button is then flattened by a hammer; is annealed by bringing it to a red heat; is laminated by passing it between rollers; is again annealed; and is rolled loosely into a spiral or coil called a *cornet.* It is now ready for the process of quartation.

For this purpose, it is introduced into a matrass containing about $1\frac{1}{4}$ ounces of nitric acid, at 22° of Baume's hydrometer; and in this acid it is boiled for ten minutes, as indicated by a sand-glass.

The acid is then poured off, and three-fourths of an ounce of stronger acid, at 32°, is substituted for it, in which the gold is boiled for ten minutes.

This second acid is then also poured off, and another equal charge of acid of the same strength is introduced, in which the gold is kept for ten minutes longer.

It is then presumed that the whole of the silver has been removed, and the gold is taken out, washed in pure water, and exposed, in a crucible, to a red heat, for the purpose of drying, strengthening, and annealing it.

Lastly, the cornet of fine gold thus formed is placed in the assay balance, and the number of thousandths which it weighs expresses the fineness of the gold assayed, in thousandths.

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TEST ASSAY.

To test the accuracy of this process, and to correct it if not exact, the following method is employed.

A roll of gold, of absolute purity, which has been kept under the seal of the Chairman of the Assay Commissioners, is opened in their presence, and from it is taken the weight of 900 units. To this are added 75 units of copper, and 25 of silver so as to form, with the gold, a weight of 1000 units, of the exact legal standard.

This is passed through the same process of assay as the other gold, and at the same time. After the assay is finished, it is evident that the pure gold remaining ought to weigh exactly 900 units. If however, from any cause, it be found to differ from this weight, and, therefore, to require a correction, it is assumed that the same correction must be made in the other assays, and this is done accordingly.

ASSAY OF SILVER COINS.

PRINCIPLES OF THE OPERATION.

The standard silver of the United States is so constituted, that of 1000 parts by weight, 900 shall be of pure silver, and 100 of copper.

The process of assay requires that the exact proportion of silver in a given weight of the compound be ascertained, and this is done by a method called the *humid assay*, which may be explained as follows.

The silver and copper may both be entirely dissolved in nitric acid; and if to a solution thus made, another of common salt in water be added, the silver will be precipitated in the form of a white powder, which is an insoluble chloride, while the copper will remain unaffected.

Now it has been ascertained that 100 parts by weight of pure salt will convert into chloride of silver just 184.25 parts of pure silver. Consequently the quantity of salt necessary to convert into chloride 1000 parts of silver, is 542.74; as found by the proportion.

184.25 : 100 : : 1000 : 542.74.

A standard solution of salt is accordingly so prepared, as that a given measure (the French decilitre) shall contain 542.74 thousandths of a

gramme, of salt. The normal weight employed for silver assays, is the gramme, (equal to about 15.4 troy grains,) which is marked 1000, and has its subdivisions, in practical weighings, to the half or quarter thousandth.

Besides this standard solution, which effects the main precipitation of chloride of silver, there is a decimal solution, of one-tenth the proportion of salt, which it is expedient to use for the lesser and final precipitations.

In the mode of assay under consideration, it is necessary that the portion of alloyed silver used shall contain as nearly as may be, 1000 parts of pure silver. The rigid standard requires, that of 1000 parts by weight, 900 shall be of pnre silver; but the law allows a variation from this ratio, provided that it do not exceed three thousandths. The fineness may, therefore, be as low as 897, and as high as 903. In the practice of the assay, it is found most convenient to assume the lower extreme. Now the weight of metal, of the fineness 897, which would contain 1000 parts of silver, is 1114.83; as found by the proportion,

897 : 1000 : : 1000 : 1114.83.

The nearest integer to this number is employed, and the weight of metal taken for the assay is 1115.

PROCESS OF ASSAY.

The reserved silver coins are melted together in a black lead crucible, with the addition of

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fine charcoal within the pot, to prevent oxidation, and to allow of dipping out. After stirring, a small portion of the fluid metal is poured quickly into water, producing a *granulation*; from which the portion for assay is taken. As this differs from the mode pursued with gold, it must be specially noted, that in the case of silver alloyed with copper, there is a separation, to a greater or less degree, between the two metals in the act of gradual solidification. Thus an ingot cooled in a mould, or any single coin cut out of such ingot, though really 900 thousandths fine on the average, will show such variations, according to the place of cutting, as might even exceed the limits allowed by law. This fact has been established by many experiments, both in this mint and the mint of Paris, since the enactment of our mint law; and it possesses the stubbornness of a law of chemistry. But the sudden chill produced by throwing the liquid metal into water, yields a granulation of entirely homogeneous mixture, and it can be proved, that the same fineness results, whether by assaying a single granule, or part of one, or a number together.

From this sample the weight of 1115 thousandths is taken; which is dissolved in a glass bottle, with nitric acid.

Into this solution the large pipette-full of standard solution of salt is introduced, and it produces immediately a white precipitate, which

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is choloride of silver, and which contains of the metallic silver 1000 units.

To make this choloride subside to the bottom of the vessel, and leave the liquid clear, it is necessary that it be violently shaken in the bottle; and this is accordingly done, by a mechanical arrangement, for the necessary time.

Unless the coins have chanced to be below the allowable limit of standard, the liquid will still contain silver in solution, and accordingly a portion of the decimal solution is introduced, from the small pipette, capable of precipitating a thousandth (and somtimes two or more) of silver, and a white cloud of choloride will show itself.

The liquid is again shaken, and cleared; and the process is thus repeated, until the addition of the salt water shows only a faint trace of chloride below the upper surface of the liquid.

Let us suppose, for the sake of an example, that three measures of the decimal solution have been used with effect. This will show that the 1115 units of the coin contained 1003 of pure silver; and thus the proportion of pure silver in the whole alloyed metal is ascertained.

TEST ASSAY.

For the foregoing process to be exact, it is neccessary that the saline solution be of the true standard strength, or be such that the quantity of it measured in the large pipette shall shall be just sufficient to precipitate 1000 parts

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of silver. This cannot be assumed without proof, and a test assay is accordingly made as follows by which the other assays may either be confirmed or corrected.

A roll of silver, known to be of absolute purity, is kept from year to year, in an envelope, under the seal of the Chairman of the Assay Commissioners. This being opened in their presence, a portion of the silver is taken, and 1004 parts carefully weighed off, and submitted to the process of assay described above. If the salt water used be of the exact standard, it is evident that as the solution in the larger pipette will precipitate 1000 parts of silver, four measures of the decimal solution will be required to precipitate the remaining four parts.

But as the normal or standard solution is affected from day to day, by changes of temperature, or other influences, the finishing decimal doses may be more, or fewer; and the other assays are to be corrected accordingly.

CALCULATION OF FINENESS.

By the assay, thus corrected, the number of units of silver contained in 1115 units of the metal under trial, is ascertained; and the fineness, in thousandths, is then found by the proportion: As 1115 is to the number of units of fine silver, so is 1000 to the fineness of the alloyed silver, in thousandths.

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Thus, if the assay show the presence of $1005\frac{1}{2}$ parts of fine silver, the fineness of the alloyed silver will be 901.8 thousandths, as found by the proportion,—

1115 : 1005.5 : : 1000 : 901.79.

It is on this principle that the following table is constructed. The numbers at the top and the fractions at the side correspond to the measures of the decimal solution used, corrected by the test assay. The numbers in the body of the table show the corresponding fineness of the assay-piece, of which the weight was 1115 units.

	0	1	2	3	4	5	6
0	896.9	897.7	898.6	899.6	900.4	901.3	902.2
$\frac{1}{4}$	897.1	898.0	898.9	899.8	900.7	901.6	902.5
$\frac{1}{2}$	897.3	898.2	899.1	900.0	900.9	901.8	902.7
$\frac{3}{4}$	897.5	898.4	899.3	900.2	901.1	902.0	902.9

In the testing of single pieces, it is to be expected, that any gold coin, or a cut from any part thereof, will conform faithfully to the bounds prescribed by law. But the silver coins, in addition to the source of error already pointed out (the manner of taking assay samples,) are somewhat liable to show too high a result,

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from several canses. At certain grades of alloy, and cspecially the standard of 900, the gradual cooling of ingots will draw the better metal to the interior, and the worst towards the exterior and the edges. Hence the fineness of pieces cut off the central part of the ingot, is higher than the average fineness of the ingot. Again, in casting ingots from a melting pot, the exposure of the metal to the air, during all the time of dipping out, and at the same the increase of heat toward the bottom of the pot, unavoidably produces a progressive refining, so that the lower ingot is of a higher quality than the average of the whole melt; and of course, a coin cut from it will be higher still. Yet with the precautions observed, our silver coins should very rarely exceed the superior limit assigned by law; and there is no good reason why they should fall below the legal limit, unless it be the taking of an unfair sample of for assay.